Specialty Conference

Participants
IVAN HARWOOD, MD
NANCY OLMSTED, MD
RICHARD RABENS, MD
ELAINE MISCHLER, MD
MICHAEL WELLER, MD
WILLIAM L. NYHAN, MD, PhD

From the Departments of Pediatrics and Radiology, University of California, San Diego, School of Medicine, and University Hospital, San Diego

Refer to: Harwood I, Olmsted N, Rabens R, et al: Croup and epiglottitis—University of California, San Diego, and University Hospital, San Diego (Specialty Conference). West J Med 123:282-289, Oct 1975

Croup and Epiglottitis

WILLIAM L. NYHAN, MD, PH D:* *The management of croup is an interesting and often provocative aspect of pediatric practice. We shall present two illustrative cases. The first will be presented by Dr. Rabens.*

RICHARD RABENS, MD:† The first patient presented at Mercy Hospital with dyspnea and stridor. He was a 3½-year-old Mexican-American boy who was well until one week before admission, when a nonspecific febrile illness developed accompanied by malaise. The whole family had the same illness. The patient improved in a few days and was well until two days before admission, when low-grade fever recurred. He was treated with one baby aspirin every four hours. On the day before admission, there continued to be a slight fever and a raspy, barking cough developed. The patient began to experience difficulty in breathing on the night before admission. The mother described the difficulty as "heavy breathing" which prevented him from sleeping well that night.

On the morning of admission the patient began retracting and grunting. He was brought to the Emergency Room at Mercy Hospital. The admitting officer noted the child to be tachypneic and to have stridor and intercostal retractions. The epiglottis was looked for specifically by the examiner but was not seen. The child was given 0.2 ml of epinephrine subcutaneously and intermittent positive-pressure breathing (IPPB) treatment with isoproterenol hydrochloride (Isuprel®) without any improvement. On an x-ray film of the chest, bilateral patchy infiltrates in both lower lobes and in the right upper lobe were seen. The child was admitted to the Pediatric Service. The history was unremarkable except for an episode of bronchitis several months previously.

On physical examination, the patient was found to be well developed and in acute respiratory distress. Inspiratory stridor and very pronounced substernal retractions were noted. A barking cough was prominent. The temperature was 101.2°F (38.4°C), the pulse 160 and respiratory rate 40 per minute, and the blood pressure 112/74 mm of mercury. There was no cyanosis. Findings on examination of the ears, eyes and nose were normal. Diffuse rhonchi were heard over the chest without wheezing. The rest of the examination gave findings within normal limits.

Laboratory studies showed a leukocyte count of 18,800 per cu mm with 76 percent segmented

*Professor and Chairman, Department of Pediatrics.
†Resident in Pediatrics.
Reprint requests to: William L. Nyhan, MD, PhD, Department of Pediatrics, University Hospital, P.O. Box 3548, San Diego, CA 92103.

cells, 4 percent band forms, 15 percent lymphocytes and 5 percent monocytes. The hemoglobin was 12.2 grams per 100 ml. Results of urinalysis and analysis of the blood for electrolytes and blood urea nitrogen (BUN) were normal. On a lateral x-ray film of the neck, some narrowing of the subglottic air column was seen. The examination in the oral pharynx was deliberately deferred and otolaryngological consultation was obtained. An intravenous infusion was started and maintenance fluids provided. Blood culture was obtained and ampicillin was given intravenously in a dose of 100 mg per kg of body weight per day. The child was put in a cool mist tent and given racemic epinephrine by mask. The anesthesiologist on call was advised of the patient's presence. The consulting otolaryngologist examined the child by indirect laryngoscopy and made a diagnosis of laryngotracheobronchitis. He felt that tracheostomy was not indicated. The child's breathing remained extremely difficult during the first few hours in the hospital, although there was slight improvement after each treatment with racemic epinephrine. The patient still required racemic epinephrine every hour for the first few treatments and then every two hours. Treatment was begun with hydrocortisone sodium succinate (Solu-Cortef®) in a dose of 2 mg per kg of body weight every six hours. There was gradual improvement through the night. By the next morning he was breathing with only moderate retractions, and he gradually improved over the next three days. Findings on an x-ray study made on the day of discharge, the fourth hospital day, showed improvement in the areas of infiltration noted originally, and the tracheal air column was not narrow.

QUESTION FROM THE AUDIENCE: *How did he tolerate the treatment with racemic epinephrine?*

DR. RABENS: He tolerated it. This patient did not struggle against it at all. He was an exhausted child. The House Staff was very worried that the child might be in too much respiratory distress. There was argument back and forth as to whether a tracheostomy should be done.

QUESTION FROM THE AUDIENCE : *How much steroid did the patient receive?*

DR. RABENS: He got, I believe, about 50 mg.

DR. NYHAN: *The second patient will be presented by Dr. Mischler.*

ELAINE MISCHLER, MD:* Our second patient was a two-year-old boy who was admitted to University Hospital with a chief complaint of respiratory difficulty. He had been well except for an episode of abdominal pain the night before admission until 11 o'clock on the morning of the day of admission when he was noted to be lethargic. There was decreased appetite and a temperature of 105°F (40.6°C) had developed. The patient was seen in the emergency room at 5 pm and found to have bilateral otitis media. At that-time there was no inspiratory stridor. He was given prescriptions for penicillin, sulfisoxazole (Gantrisin®) and Dimetapp® and sent home. At 11 pm he was brought back to the emergency room because of inspiratory stridor. At that time, a temperature of 103°F (39.4°C) was present. The mother reported that this difficulty in breathing had developed during a period of approximately one hour. The patient was admitted with a diagnosis of probable acute epiglottitis. The history was otherwise noncontributory.

On admission the vital signs included a pulse of 150 and respirations of 24 per minute. Respirations were labored, and there was inspiratory stridor and pronounced substernal retractions. The temperature was 102°F (38.9°C). The child sat leaning forward. He had a very anxious appearance, and it was very impressive to watch him breathe. He was not cyanotic. There were dull tympanic membranes bilaterally and shotty cervical adenopathy. The lungs were clear, and findings on cardiac examination were normal. The rest of the physical examination gave entirely normal findings.

Laboratory data showed a leukocyte count of 20,900 per cu mm with 72 percent segmented cells, 17 percent band forms, 9 percent lymphocytes and 2 percent monocytes. The hematocrit was 37. The serum concentrations of electrolytes, the BUN and the urinalysis were all within normal limits.

It was decided to defer examination of the epiglottis until the child could be taken to the operating room, so that if a tracheostomy was needed, it could be done under controlled conditions. The child was given racemic epinephrine by nebulizer with no improvement. Intravenous

*Chief Resident in Pediatrics.

ampicillin was begun in a dose of 200 mg per kg of body weight. Mild hyperaeration was noted on an x-ray film of the chest. On a lateral x-ray study of the neck, there was questionable glottic and subglottic edema. The child had just arrived in the operating room when he became completely obstructed. Intubation was carried out. Then a tracheostomy was placed. We looked at the epiglottis after the tracheostomy, and it was erythematous and about four times normal in size. Subsequently the child's throat culture grew out Hemophilus influenzae.

The hospital course was uneventful. The tracheostomy tube was removed after five days.

DR. NYHAN: *If there are no questions we shall turn to Dr. Weller for evaluation of the roentgenological features of this problem.*

MICHAEL WELLER, MD:* Radiography of the neck requires proper positioning in order to make the diagnosis of croup or epiglottitis or both. The neck must be fully extended. If the films are done upright, the chin must be elevated and the head well back. If the films are done supine, the shoulders must be elevated so that the head drops back enough to get a cross table lateral film which shows the neck in full extension. This is the position of maximal airway caliber. Most children will not resist this positioning. The arms must be pulled down toward the feet, either by a parent or suitable restraints, in order for the subglottic airway to be seen in the lateral view.

It is always worthwhile to review the normal anatomy of the oropharynx and larynx before launching any discussion of croup or epiglottitis. Examining the neck in the lateral projection, one can usually see air in the valleculae, which are small depressions formed by the medial and lateral glossoepiglottic folds. These are located just above the body of the hyoid bone in the lateral view. Extending from the valleculae, a soft tissue shadow, finger-like in configuration, is noted which is the free margin of the epiglottis. From the free margin of the epiglottis, the aryepiglottic folds sweep downward posteriorly, and show a concave posterior configuration. Where they meet the posterior pharyngeal wall is a mound of soft tissue representing the arytenoid cartilages. A small oval lucency just anterior to the arytenoid cartilages represents the laryngeal ventricle. Bands of soft tissue density above and below the laryngeal ventricle represent the false and true vocal cords, respectively. The subglottic tracheal airway begins at the bottom of the true cords. In the lateral view, mild anterior buckling of the subglottic airway is a normal variation, which can be eliminated by further extension of the neck. In the anteroposterior projection, lateral paired air-containing structures are the pyriform sinuses. The inferior limit of the pyriform sinuses usually localizes the level of the true vocal cords. From this point downward, the trachea begins as the subglottic airway. In the anteroposterior projection the subglottic airway, from the under surface of the true cords, usually has a rounded shoulder and has been likened to the configuration of a gothic arch.

The typical radiologic signs of croup are those of subglottic narrowing of the trachea in both the anteroposterior and lateral projections (Figure 1). Because of the peculiar laxity of the mucosa and lack of adherence of mucosa to the submucosa in the proximal few centimeters of the subglottic trachea, this area develops the most severe edema with acute infectious croup. In the anteroposterior view, this edema produces airway narrowing, obliterating the normal subglottic gothic arch configuration. The airway then takes on a much more tapered appearance, similar to a sharpened pencil, or byzantine arch. In the lateral view, both decreased caliber and decreased radiolucency of the subglottic area, because of diminished air in the lumen of the trachea at this level, are noted.

The radiologic differential diagnosis of croup includes subglottic hemangioma, but the history is usually quite different. Subglottic hemangiomas usually do not present with an acute onset, but rather with symptoms soon after birth. Other differential diagnostic possibilities include an aryepiglottic cyst or edema from a nonopaque foreign body.

A child with epiglottitis presents a somewhat different picture. The lateral view of the neck is the single most important projection for the diagnosis of epiglottitis (Figure 2). As the edema of the epiglottis becomes pronounced, the valleculae are obliterated. The normal finger-like epiglottis becomes hugely swollen and the aryepiglottic folds become either straight or convex posteriorly, compared with the normal concave posterior configuration.

It is important to remember that children with

*Associate Adjunct Professor of Radiology.

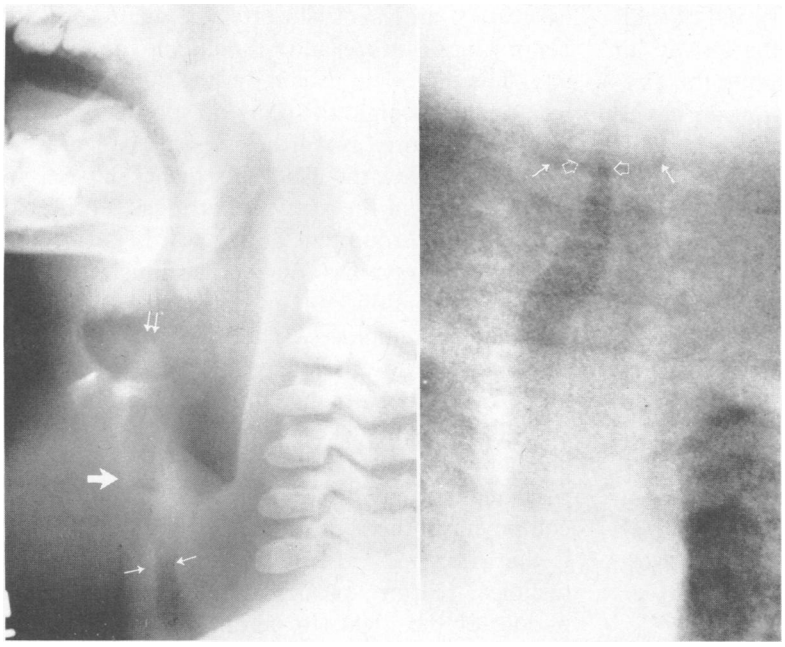

Figure 1.—Left, croup, lateral neck radiograph. The single arrows indicate subglottic narrowing. Note the normal epiglottis (double arrows) and laryngeal ventricle (broad arrow). **Right,** croup, anteroposterior neck radiograph. (Same patient in both left and right figures.) The single arrows indicate the inferior limit of the pyriform sinuses, which also corresponds to the level of the true cords. Subglottic narrowing is present (open arrows). Note the normal buckling of the trachea to the right.

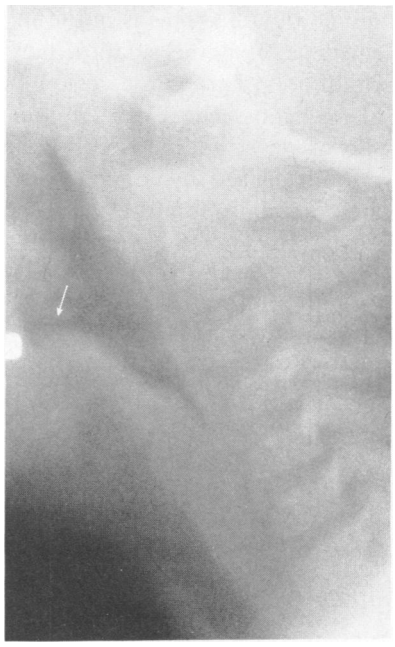

Figure 2.—Epiglottitis. Lateral neck radiograph. The epiglottis is swollen (arrow) and has lost its normal finger-like configuration (compare with Figure 1, Left). The subglottic airway is normal.

epiglottitis may have croup also. Neck films in both the anteroposterior and lateral projections should be done whenever upper airway obstruction of any kind is suspected. It is my feeling that in any child with croup or epiglottitis, lateral films of the neck ought to be made before direct visualization of the epiglottis is attempted. However, this is with the understanding that the child should come to the x-ray department with a physician in attendance, who should be prepared to carry out emergency intubation if necessary. Films obtained on the second patient presented showed classic epiglottitis.

DR. NYHAN: I agree with Dr. Weller on the subject of carrying out x-ray studies in a patient with croup. It is especially a problem because these emergencies often occur in the middle of the night. The other point we should reiterate is that the physician going with the patient should bring the appropriate equipment so that he can do something if something happens. Another comment is that these roentgenographic distinctions look easy when Dr. Weller provides his usual beautiful demonstration. We can all see these things clearly when he points them out to us. It is much more difficult in the middle of the night. The physician may need not only a good position on the film, but he may need an expert like Dr. Weller in order to read them.

Our next speaker will be Dr. Nancy Olmsted.

NANCY OLMSTED, MD:* There are four possible sites of obstruction in the upper airway: at the level of the epiglottis, at the level of the vestibular folds, at the level of the larynx and in the subglottic area. The two levels that are of concern to us today are the epiglottis and the subglottic region. The vestibular folds may become involved with chemical inhalations and foreign bodies, and the larynx may be an important site of cysts or laryngeal paralysis. In epiglottitis, the course is usually of sudden onset with high fever in a toxic patient. Such a patient may present with a wide open mouth, the tongue sticking out, and drooling. There may be dysphagia. The patient is very sick. In this disorder the inflammation is not limited to the epiglottis. It may also involve the aryepiglottic folds so that edema is present both anteriorly and posteriorly.

In croup, the swelling is most prominent in the

*Fellow in Pediatric Pulmonary Disease.

subglottic area. This is in the region of the cricoid cartilage. It is the smallest part of the airway in childhood. This is the region that limits the size of an endotracheal tube. In general, croup has a slower onset and less fever than epiglottitis. It is usually caused by a virus. Parainfluenza viruses are commonly found in patients with croup. Very severe croup has been associated with influenza A virus. The disorder can be caused by a number of other viruses, including respiratory syncytial virus and occasionally enteroviruses such as echo and Coxsackie. It is important to remember that laryngeal croup can be caused by diphtheria. The characteristic presentation is of a very toxic child with a history of no immunizations.

DR. NYHAN: *We shall turn now to Dr. Harwood for consideration of the management of these problems.*

IVAN HARWOOD, MD:* The two patients presented in this conference were classic examples, the first of viral croup and the second of Hemophilus influenzae epiglottitis. These clinical syndromes are well known. I would like to discuss some of the more controversial aspects of diagnosis and treatment. There has been considerable recent literature, particularly on newer methods of diagnosis and treatment, and much of it is contradictory. When a child presents with a severe croup syndrome, inspiratory stridor, cough, hoarseness and signs of obstruction, a critical consideration is the cause—is it viral or is it bacterial (that is, due to Hemophilus influenzae). The reasons are the therapeutic implications. In 11,400 cases of viral croup as tabulated by Adair,[1] an average of 5 percent required a tracheostomy. The range was 0 to 13 percent. In smaller groups of patients with epiglottitis due to H influenzae, 70 to 100 percent required an artificial airway. In these patients, obstruction developed so severe that intervention was required and usually tracheostomy. Perhaps more important is the rapidity and capriciousness of this disease process. As illustrated in the second case, complete obstruction may appear very rapidly. It often has a way of happening when and where you least expect it. These are the reasons for making an unequivocal diagnosis in a patient with a severe croup syndrome.

There are three principal ways in which to differentiate these two entities. The first of these is clinical. A judgment can often be made from the history, appearance and response to initial therapy. The danger in relying on the clinical presentation is that epiglottitis may not present with the classical picture. Nevertheless, the patient may go on and follow the usual fulminant course while the patient is in the x-ray department, in the elevator or in a croup tent on the ward. The second way is by x-ray. Dr. Weller has illustrated that x-ray examination can be diagnostic. Two dangers deserve emphasis. The first is that the patient may obstruct while x-ray studies are being made. The positioning, manipulation and restraints that are necessary to get the films may promote obstruction. We have discussed the importance of having the proper personnel and equipment in the x-ray suite. The second problem is that films may not be of sufficient quality for technical reasons, particularly when done in the middle of the night, to permit a diagnosis. Possibly a combination of technical difficulties and inexperience of the person looking at the x-ray films may be why this method does not invariably provide the diagnosis. Visual inspection is the third approach to definitive diagnosis. The short oral pharynx of a younger child and an epiglottis that may be two to four to six times normal size, make it almost always possible to visualize the epiglottis by simple inspection. This is without any instrumentation in about 30 percent of the patients and with quick gentle pressure with a tongue blade in the rest of the patients. If a large cherry-red colored epiglottis is seen, it surely must be one of the most certain diagnoses in pediatrics.

The dangers of visual inspection are also two. First, visualization may be inadequate. This is related more to the skill and determination of the examiner than to variations in the anatomy. The second problem is a danger that is discussed every time this technique is brought up, that of precipitating a respiratory arrest by the manipulation involved in looking, particularly with a tongue blade. In a review of 103 cases of H influenzae epiglottitis, Baxter,[2] at the Montreal General Hospital, came to the conclusion that this is not an important consideration. The epiglottis and aryepiglottic folds are so swollen and so rigid in the later stages of the disease that a wait of five minutes, a few drops of saliva into the vallecula or a change in position can precipitate obstruction. In this disease, later sometimes means minutes. In other words, the child who is

*Assistant Professor of Pediatrics.

going to obstruct with a quick look and by one deep pass of the tongue blade is likely to obstruct two minutes later with nothing else being done. If this is the case, it should be contrived that the inevitable intubation occurs under optimal circumstance. Where these circumstances are obtained depend on the institution and the personnel and equipment available, and it will vary from institution to institution. Generally, the place should be the operating room, the emergency room or the intensive care unit. Access to all of the necessary tracheal intubation equipment should be insured including a rigid pediatric bronchoscope. Personnel involved should be a pediatrician, an otolaryngologist and an anesthesiologist. Once a diagnosis of epiglottitis is made, a tracheostomy should be done. I do not personally believe in waiting for medical therapy to take effect. The odds are just too strongly against its effectiveness. The available data support the idea that once the diagnosis is made, a tracheostomy should follow promptly.

Another controversy that comes up at this point is whether to use a nasotracheal tube or a tracheostomy. Intubation is almost always going to last more than 24 hours. My own feeling is that there are too many complications of prolonged intubation with upper airway disease for nasotracheal intubation to be an acceptable method of management. Downes[3] has reviewed the use of nasotracheal tubes in patients with croup. In 18 patients with upper airway obstruction treated with nasotracheal tubes, there were severe late complications in 11. There were two deaths and three patients with late tracheal stenosis. This probably occurs because of a foreign body (the tube) in an area that is intensely inflamed. If a patient is obstructed enough to require an airway, the opening may be pinpoint. To provide an adequate airway, you must use a hard tube that compresses the delicate, inflamed tissue.

Let us consider the other group of patients. If the diagnosis is not epiglottitis by history, inspection and x-ray examination, then it is probably viral croup or laryngotracheobronchitis. The mainstay of therapy in this disease has become nebulized racemic epinephrine. It is usually given in a dose of ½ ml in 3½ ml of saline and delivered by IPPB for 10 to 15 minutes, usually by mask. It may be repeated as required. The limitation on how often this therapy can be repeated is tachycardia, which is not often seen with this drug. Proper use is important. The drug has to be delivered to the target organ. Wafting a gentle mist of epinephrine over the child's face does not get any of the drug into the inflamed area. Initially it is often necessary to hold a struggling, sick child with a mask clamped on his face and the inspiratory time on the respirator set so that there is a long inspiratory time to insure adequate delivery of the drug. Some of the problems encountered in using this regimen have been related to a lack of aggressiveness in clamping the mask tightly to the face. The treatment works by local effect. Vasoconstriction can shrink inflamed mucous membranes. Systemic epinephrine should not be employed, as it has no effect on subglottic edema. It may increase the oxygen requirement of the child, and in someone who may be at the compensation point, an increase in oxygen requirement may trigger respiratory failure. A mist tent is probably of no real value. It may be dangerous because when a child is wet, he loses heat which increases the oxygen requirement. For the doctor there may be a loss of visual contact with the patient in the tent. Oxygen is employed only in an emergency. A patient with croup who is cyanotic is in respiratory failure. The use of steroids remains controversial.

In viral croup or in epiglottitis, a child may arrest under less than ideal conditions, in a place where the tools for definitive therapy are not at hand. The child can no longer breathe or is about to arrest and is cyanotic. My first choice of a way to handle the situation is to employ an oral tracheal tube. I use the Cole tube because it has a shoulder. It narrows down to the small portion of the tube that actually goes into the airway. The tube is stiffer than other tubes and has a sharper bevel. One does not need wire or other mechanical devices in the tube to stiffen it. A tube should be used that is approximately half the size that would normally be chosen for a particular child. The aim is to provide an emergency airway that will be adequate until the child can be provided with a tracheostomy. If this cannot be accomplished in about 30 to 60 seconds, then a cricothyroid puncture is mandatory. There is no such thing as an emergency tracheostomy. It takes too long. It is also an extremely hazardous procedure if it is done under less than controlled circumstances. On the other hand a cricothyroid membrane puncture is easy. The landmarks are easy to identify. If you feel the thyroid cartilage, the Adam's apple, then right below it is the

cricoid ring, and as you put your finger from one to the other there is a space between the two. This is the place to make the hole. It can be made with a trocar, a pen knife or scalpel. The usual technique is to take the blade of the scalpel and make a horizontal puncture in the cricothyroid membrane and then take the handle of the scalpel, put it in and turn it vertically providing an opening through which the child can breathe.

These considerations raise the question of needles. Needles are not adequate to provide an airway for a child. An easy way to prove this is to get some 15 gauge needles, two or three even, put them in your mouth and try to breathe through them. It is not possible to move enough air through them. It is important to forget about needles, look at the anatomy book and feel the landmarks on one's own neck or somebody else's until one knows where the cricothryoid membrane is and then to be prepared mentally to puncture it if the situation demands.

Summing up the management of severe croup, first of all, have a plan that is tailored for each institution or each situation and have it available and well known by all of those who may be involved in first-line care. Second, epiglottitis should be suspected in any child that is croupy. Third, a visual inspection should be made under optimal circumstances. If the epiglottis appears to be normal or cannot be seen, then x-ray studies should be done. If a cherry-red colored epiglottis is seen, the patient should be taken directly to the operating room, or whether tracheostomy is done. In dealing with this problem, the pediatrician should always be mentally prepared for the worst.

QUESTION FROM THE AUDIENCE: *How often does a child need a tracheostomy on the second attack of croup?*

DR. HARWOOD: I do not think that a second attack is necessarily an indication for tracheostomy. It has not been tabulated in series and reported. Adair has listed all of the large published reports on viral croup and tracheostomy and mortality. We have more recently received a letter from him in response to an article that reported that patients with croup did not respond to racemic epinephrine, and in his experience no patient treated with racemic epinephrine has required tracheostomy in approxihately 500 patients over the last seven years.

QUESTION FROM THE AUDIENCE: *How many times do you use racemic epinephrine?*

DR. HARWOOD: If we restrict our experience to viral croup, not epiglottitis, we expect an immediate response, but the airway obstruction may recur. Then we repeat it as often as necessary. Tachycardia is the limiting side effect. In a patient with very severe viral croup that responds to racemic epinephrine, it is reasonable to give a 10 minute treatment and 15 to 20 minutes later to give another treatment for 5 or 10 minutes.

QUESTION FROM THE AUDIENCE: *Do blood gas determinations help in the management of croup?*

DR. HARWOOD: Yes, they do. If you find desaturation, that means physiological hypoventilation; if a patient is cyanotic, there is going to be an elevated carbon dioxide level, and this means respiratory failure. Most of the time when a child is cyanotic things are happening very quickly, and if a patient is desaturated, you know it. The other relevant problem is a patient with long drawn out viral croup. The patient may be getting tired and very gradually begin hypoventilating. This type of patient may fool you clinically, and blood gases may be very helpful in that situation, more so than in an acute emergency.

QUESTION FROM THE AUDIENCE: *Once you have seen the epiglottis, why get an x-ray film?*

DR. HARWOOD: It is not necessary in epiglottitis. But if the epiglottis is normal, there may be something in there, such as a foreign body. There may be a cyst or a tumor. If there is another abnormality, the patient is more likely to develop a croup syndrome. I think it is reasonable to get an x-ray film on the first episode of croup in any child. It is not necessary in a patient with repeated episodes of croup.

QUESTION FROM THE AUDIENCE: *Do you admit all patients you treat with racemic epinephrine?*

DR. HARWOOD: There are differences of opinion. Adair has said that he uses racemic epinephrine on outpatients. He gives them racemic epinephrine, and if they get better, he sends them home. I would not recommend that. I think that anyone sick enough to require racemic epinephrine should be in the hospital.

DR. NYHAN: *Something that has been bothering me you alluded to earlier. Dr. James Cherry has recently reported in* Pediatrics[4] *what looked to me like a controlled study on racemic epinephrine and as I remember reading it, he could not tell the control from the treated. Do you have a comment on that study?*

DR. HARWOOD: Yes. The controlled part of that study involved twenty patients. The number seemed to me to be inadequate. He did not state whether patients that did poorly and did not respond to racemic epinephrine had epiglottitis. There was no information as to which disease entity he was treating. This was what prompted the questionnaire from Dr. Adair. He was inquiring about experience in treating epiglottitis, and he did not expect them to respond.

QUESTION FROM THE AUDIENCE: *Would you treat a patient with epiglottitis with ampicillin?*

DR. HARWOOD: I believe that epiglottitis is caused by Hemophilus influenzae. Today the drugs of choice are ampicillin and chloramphenicol.

REFERENCES

1. Adair JC, Ring WH, Jordan WS, et al: Ten year experience with IPPB in the treatment of acute laryngotracheobronchitis. Anesth Analg (Cleve) 50:649-654, 1971

2. Baxter JD: Acute epiglottitis in children. Laryngoscope 77: 1358-1367, 1967

3. Striker TW, Stool S, Downes JJ: Prolonged nasotracheal intubation in infants and children. Arch Otolaryngol 85:210-213, 1967

4. Gardner HG, Powell KR, Roden VJ, et al: The evaluation of racemic epinephrine in the treatment of infectious croup. Pediatrics 52:52-55, 1973

Repeated Taps vs. Craniotomy for Subdural Hematomas

For a number of years neurologists interested in this particular field have questioned the value of craniotomy and the extensive use of surgical procedures recommended in the past and stemming largely from the experience of neurosurgeons . . . The operation itself, which is a very extensive and traumatic operation, cannot possibly remove all the membranous material and clotted blood that make up a chronic subdural hematoma. One can achieve as much by multiple aspirations of fluid from the subdural space, carrying out a subdural tap whenever there is a sign of increased pressure, such as fullness of the fontanelle or vomiting or the sudden onset of fever to suggest that enough fluid has accumulated to justify another tap. And so we now have two schools of thought—the original one consisting of the craniotomy and the second one consisting of tapping repeatedly until fluid is no longer attained. The group advocating the repeated taps will admit that a certain percentage of children will continue to show fluid with repeated tapping and that this is finally treated by setting up or establishing a shunt from the subdural space so that fluid will continually discharge from this space until the brain expands to fill the space and fluid formation comes to an end. I personally think that the data that are accumulating in this particular field strongly suggest that repeated tapping is as successful, if not more so, than the craniotomy and I believe that more and more neurosurgeons are being won over to the medical (if you can call it medical) approach with repeated taps than by extensive use of surgical operation.

—SYDNEY S. GELLIS, MD, *Boston*

Extracted from *Audio-Digest Pediatrics,* Vol. 20, No. 24, in the Audio-Digest Foundation's subscription series of tape-recorded programs. For subscription information: 1930 Wilshire Blvd., Suite 700, Los Angeles, California 90057.